REPORT ON

WEED MONITORING PROGRAM

IN AREAS WHICH HAVE BEEN DEVELOPED BY

TRUE GEOTHERMAL ENERGY CO.

IN

BLNR DESIGNATED GEOTHERMAL DEVELOPMENT SUBZONE

MIDDLE EAST RIFT ZONE OF KILAUEA

(WA'O KELE O PUNA)

by

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During each visit to the site after road and drill site clearing occurred, observations were made of the distribution of species colonizing all areas cleared during the process of geothermal development. The pre-clearing survey was made on Nov. 14, 1987, and post-clearing surveys were made on: July 9, 1989, December 16, 1989, January 13, 1990, May 18, 1990, June 9, 1990, August 12, 1990, December 1, 1990, and February 2, 1991. A summary of these observations is provided in the table which follows. A total of 67 species and varieties of higher plants have been found colonizing cleared sites. Of these 49 are alien species, 2 are probably Polynesian introductions, 1 is either indigenous or a Polynesian introduction, 6 are indigenous and 9 are endemic to the Hawaiian islands. Methods of control of the alien species are currently being applied on an experimental basis, with due care taken to protect the native species and to encourage the expansion of the area occupied by natives.

There are several native species which have increased in abundance in these cleared areas. Most notable are mamaki (*Pipturus albidus*), `uki (*Machaerina angustifolia* and *M. mariscoides* ssp. *meyenii*), and *Pycreus polystachyos*. These are species which often occur in disturbed areas early in succession. Mamaki is of special interest since it grows into a shrub, 10 feet or more tall, which casts dense shade that can inhibit the growth of alien species that might otherwise occupy the area. Efforts should be made to encourage this species, both by scattering seeds in areas where it is not growing thickly, and by controlling alien species which are growing near it and inhibiting its growth. The alien species which is competing most effectively is sourbush (*Pluchea symphytifolia*); this species should be controlled since it has increased in abundance in the cleared areas, and it is the only alien species which has increased in these areas that is likely to persist and inhibit the recovery of native species.

Some of the alien species which were conspicuous immediately after clearing are annual species that are typical of the earliest stages of succession but are quickly shaded out and are now decreasing in numbers. These include fireweed (*Erechtites valerianifolia*) and *Crossocephalum crepidioides*. These species do not persist in closed canopy forest except in small numbers in areas disturbed by pigs, and they should continue to decrease as succession proceeds in the cleared areas.

The goal of the weed control program in these cleared areas should be to promote natural succession of native species as much as possible. To this end, general application of herbicides over large areas is not desirable, since widespread vegetation removal merely results in setting back the successional process to an earlier stage and providing further opportunity for invasion of alien species. Rather, herbicide use should be limited to spot applications on particular target species, or areas of particularly dense infestation of aliens.

SUMMARY TABLE
PLANTS COLONIZING AREAS CLEARED FOR GEOTHERMAL DEVELOPMENT IN MIDDLE EAST RIFT ZONE OF KILAUEA VOLCANO

PTERIDOPHYTES - FERNS AND FERN ALLIES

BLECHNACEAE

Sadleria cyatheoides Kaulf. 'ama'u E

Some young plants at edge of drill site.

DICKSONIACEAE

Cibotium chamissoi Kaulf. hapu'u 'i'i E
Cibotium glaucum (J. Sm.) Hook. & Arnott hapu'u E

Both species have resprouted from buried plants on road and drill pad margins, some have been intentionally planted on road margins.

HEMIONITIDACEAE

Pityrogramma calomelanos (L.) Link gold fern, silver fern X

Many young plants appearing on road and drill site margins.

LINDSAEACEAE

Sphenomeris chinensis (L.) Maxon pala'a, palapala'a I

Several young plants appearing on road and drill site margins

LYCOPODIACEAE

Lycopodium cernuum L. wawae'iole I

A few plants, primarily at margins of drill site

NEPHROLEPIDACEAE

Nephrolepis multiflora (Roxb.) Jarrett ex Morton hairy swordfern X

Many young plants growing on road and drill site margins.

THELYPTERIDACEAE

Christella dentata (Forsk.) Brownsey & Jermy downy woodfern X
Christella parasitica (L.) Levl. woodfern, oakfern X

Some young plants appearing on road and drill site margins.

Macrothelypteris torresiana (Gaud.) Ching I

A few young plants, primarily at drill site margins.

ANGIOSPERMS - MONOCOTYLEDONS

AGAVACEAE

Cordyline fruticosa (L.) A. Chev. ki, ti P

A few plants have been intentionally planted along roadside.

COMMELINACEAE

Commelina diffusa Burm. f. honohono X

Here and there on margins of road and drill site.

CYPERACEAE

Cyperus halpan L. X

Common on roadside and at drill site, especially in wetter spots where standing water persists longer. Usually growing with *Pycreus polystachyos*.

Kyllingia brevifolia Rottb. kili'o'opu, kyllingia X

In a few wet spots, mainly at drill site.

Machaerina angustifolia (Gaud.) T. Koyama `uki I

A few young plants seen, mostly on roadside.

Machaerina mariscoides (Gaud.) J.Kern ssp. *meyenii* (Kunth) T. Koyama 'uki, ahaniu I

A common colonizer along road, and particularly common at drill site.

Pycreus polystachyos (Rottb.) P. Beauv. I

Common on roadside and at drill site, especially in wetter spots where standing water persists longer. Usually growing with *Cyperus halpan*.

ORCHIDACEAE

Arundina graminifolia (D.Don) Hochr. bamboo orchid X

Here and there on margins of road and drill site.

Spathoglottis plicata Blume Malayan or Philippine ground orchid X

Here and there on margins of road and drill site.

POACEAE

Andropogon virginicus L. broomsedge, yellow bluestem X

Here and there on margins of road and drill site.

Axonopus fissifolius (Raddi) Kuhlm. narrow-leaved carpetgrass X

Here and there on margins drill site.

Digitaria fuscescens (K. Presl) Henrici creeping kukaepua`a X

A few plants along roadside near gate.

Oplismenus compositus (L.) P. Beauv. X
Oplismenus hirtellus (L.) P. Beauv. honohono kukui, basketgrass X

A few small patches on road margins, mostly *O. hirtellus*.

Panicum maximum Jacq. var. *maximum* Guinea grass X

A few plants on road margins outside the gate.

Paspalum conjugatum Bergius mau'u Hilo, Hilo grass X

Scattered plants on margins of road and drill site.

Paspalum urvillei Steud. Vasey grass X

A few plants along roadside near gate.

Sacciolepis indica (L.) Chase Glenwood grass X

A few plants in the experimental drill site just inside the gate.

Schizachyrium condensatum (Kunth) Nees bush beardgrass X

A few plants on margins of road and drill site.

ANGIOSPERMS-DICOTYLEDONS

ASTERACEAE

Ageratum conyzoides L. ageratum, maile hohono X
Ageratum houstonianum Mill. ageratum, maile honohono X

Common on margins of road and drill site, mostly *A. houstonianum*.

Bidens pilosa L. ki, ki nehe, Spanish needle X

A few plants along roadside near gate.

Crassocephalum crepidioides (Benth.) S. Moore X

Common on margins of road and drill site.

Erechtites valerianifolia (Wolf) DC fireweed X

Common on margins of road and drill site.

Gnaphalium sandwicensium Gaud. `ena`ena E

One plant found, on east side of drill site.

Pluchea symphytifolia (Mill.) Gillis sourbush X

Common on margins of road and drill site.

BUDDLEIACEAE

Buddleia asiatica Lour. dog tail, huelo 'ilio, butterfly bush X

Common on margins of road and drill site.

CARYOPHYLLACEAE

Drymaria cordata (L.) Willd. ex Roem. & Schult. drymaria, pipili X

A few plants on margin of road and drill site.

CLUSIACEAE

Hypericum mutilum L. St.John's wort X

A few plants on margin of road and drill site.

CONVOLVULACEAE

Ipomoea triloba L. little bell X

A few plants in the experimental drill site just inside the gate.

FABACEAE

Chamaecrista nictitans (I.) Moench — partridge pea, lauki X

A few plants on margin of drill site.

Crotalaria incana L. — fuzzy rattlepod X

A few plants in the experimental drill site near the gate.

Desmodium sandwicense E. Mey. — Spanish clover X

A few plants in the experimental drill site near the gate.

Mimosa pudica L. var. *unijuga* (Duchass. & Walp.) Griseb. — sensitive plant, sleeping grass X

A few plants on margins of road and drill site.

LAMIACEAE

Hyptis pectinata (L.) Poit. — comb hyptis X

Scattered plants on road margin.

LYTHRACEAE

Cuphea carthagenensis (Jacq.) Macbr. — tarweed, Columbian cuphea X

Fairly common on margins of road and drill site.

MELASTOMATACEAE

Melastoma candidum D. Don — Malabar melastome X

Abundant on margins of road and drill site.

MYRTACEAE

Metrosideros polymorpha Gaud. var. *glaberrima* (H.Lev.) St.John — 'ohi'a lehua E
Metrosideros polymorpha Gaud.var. *incana* (H.Lev.) St.John — 'ohi'a lehua E
Metrosideros polymorpha Gaud.var. *macrophylla* (Rock) St.John — 'ohi'a lehua E

Many small seedlings just starting to grow on road and drill site margins. Plants still too small to determine if all 3 varieties present.

Psidium cattleianum Sabine forma *cattleianum* — strawberry guava, waiawi 'ula 'ula X
Psidium cattleianum Sabine forma *lucidum* Degener — yellow strawberry guava, waiawi X

Many small seedlings starting to grow on road and drill site margins. Plants still too small to determine if both forms are present.

Psidium guajava L. — guava, kuawa X

Some small seedlings starting to grow on road margin.

ONAGRACEAE

Ludwigia octovalvis (Jacq.) Raven — kamole, primrose willow — I?P?

Abundant in very wet places on road and drill site margins.

Ludwigia palustris (L.) Elliott — water purselane — X

A few plants in places with standing water.

OXALIDACEAE

Oxalis corniculata L. — yellow wood sorrel, `ihi `ai — P?

A few plants along the roadside near the gate, and a few more at the drill site.

POLYGALACEAE

Polygala paniculata L. — polygala — X

A few plants along roadside near the entrance gate.

ROSACEAE

Rubus rosifolius Sm. — thimbleberry, Mauritius raspberry — X

Scattered plants along road and drill site margins.

RUBIACEAE

Paederia scandens (Lour.) Merr. — maile pilau — X

A few vines growing in the area before the road was built have sent new branches out onto the road margins.

Psychotria hawaiiensis (A. Gray) Fosb. var. *hawaiiensis* — kopiko 'ula, 'opiko — E

A few small seedlings are starting to grow on the margins of the road and drill site.

Spermacoce assurgens Ruiz & Pav. — buttonweed — X

A few plants on the road margin.

SCROPHULARIACEAE

Castilleja arvensis Cham. & Schlechtend. Indian paintbrush X

Some plants along the roadside near the gate and in the nearby experimental drill site.

Lindernia crustacea (L.) F. v. Muell. lindernia, false pimpernel X

Some plants on the road margins near the entrance gate.

Torenia asiatica L. Ola'a beauty, nanioola'a X

Two plants were found at the edge of the drill site. Both were pulled out.

URTICACEAE

Pipturus albidus (Hook. & Arnott) A. Gray mamaki, mamake E

Many young plants have started growing on the margins of the road and drill site. The largest are about 3 feet high.

VERBENACEAE

Stachytarpheta dichotoma (Ruiz & Pav.) Vahl Cayenne vervain, owi, oi X

Here and there on margins of road and drill site.

Verbena litoralis Kunth verbena, owi, oi X

A few plants on road and drill site margins.